

Driving a WS2812B RGB LED module with a 3.3-volt microcontroller (#28085 & #28086)

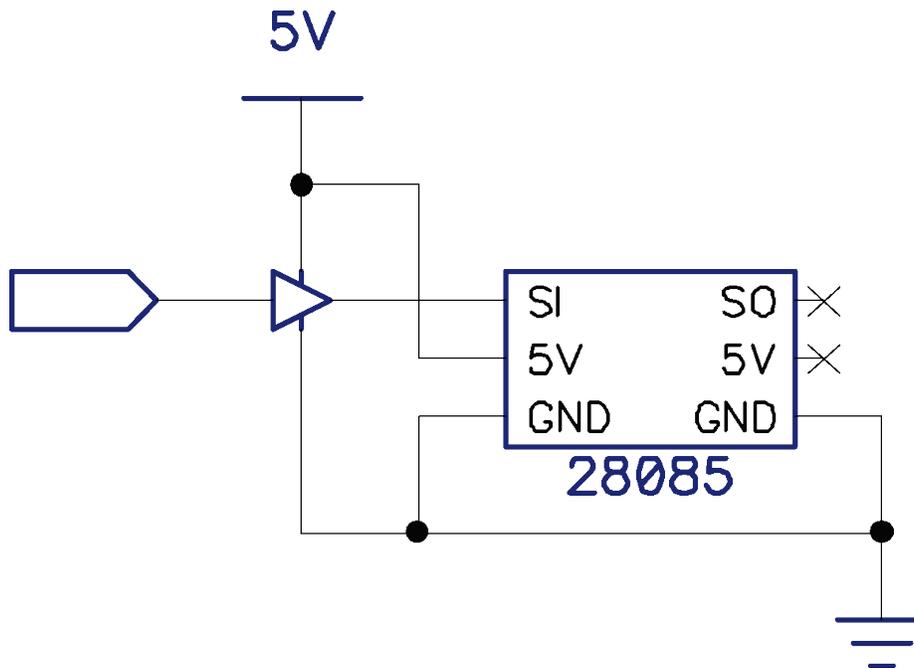
The WS2812B RGB LED module requires a 3.5 to 5.3 volt power supply. To drive the LED module, a microcontroller must use data signals that reach at least 70% of the module's power supply voltage.

For 3.3 volt microcontrollers, including the Propeller P8X32A, there are two typical approaches. Either boost the microcontroller's data signal to at least 70% of the supply voltage for the WS2812B module, or reduce the WS2812B module's supply voltage so it is no more than 45% higher than the data signal.

A buffer can boost the microcontroller's data signal. A silicon diode may suffice to reduce the WS2812B's supply voltage. These approaches work for single LEDs, or can be adapted for several chained together. In a pinch, a transistor such as those included in several Propeller microcontroller kits can serve in place of a silicon diode. The example circuits below illustrate each of these solutions.

Boosting the Signal with a Buffer

A 5-volt buffer capable of reading 3.3-volt signals can increase the signal voltage enough to work with a WS2812B module. The following schematic demonstrates how to connect a Propeller I/O pin to output a data signal to a WS2812B module, using a buffer:

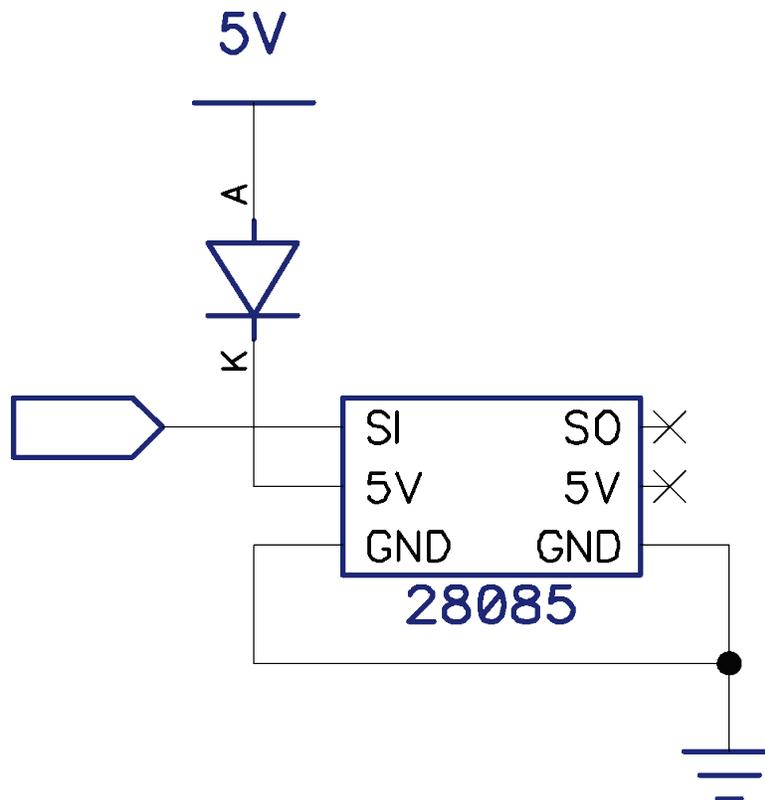


Reducing the Supply Voltage with a Silicon Diode

If the supply voltage is no more than 45% higher than the signal voltage, WS2812B module can read a 3.3-volt signal. Ideally, the WS2812B module would have a dedicated 4.3-volt regulator. If a 5-volt regulated power supply is all that is available, it is possible to use a standard silicon diode to reduce the LED module's supply voltage.

Select a standard silicon diode capable of driving 75 mA or more, such as a 1N4148 or 1N4007, to drop the voltage by approximately 0.7 volts, to 4.3 volts. This will allow for microcontroller data signals as low as 3 volts.

The following schematic demonstrates how to directly connect a Propeller microcontroller to a WS2812B module, when powering the WS2812B module from a regulated 5-volt power supply and dropping the voltage with a standard silicon diode:

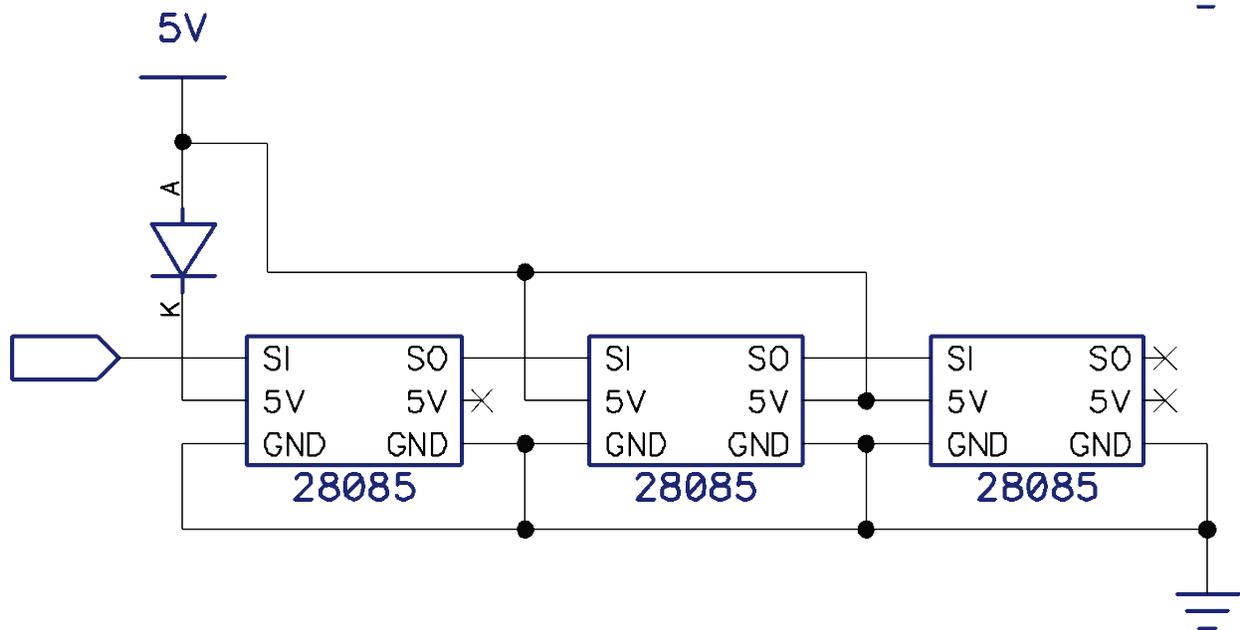
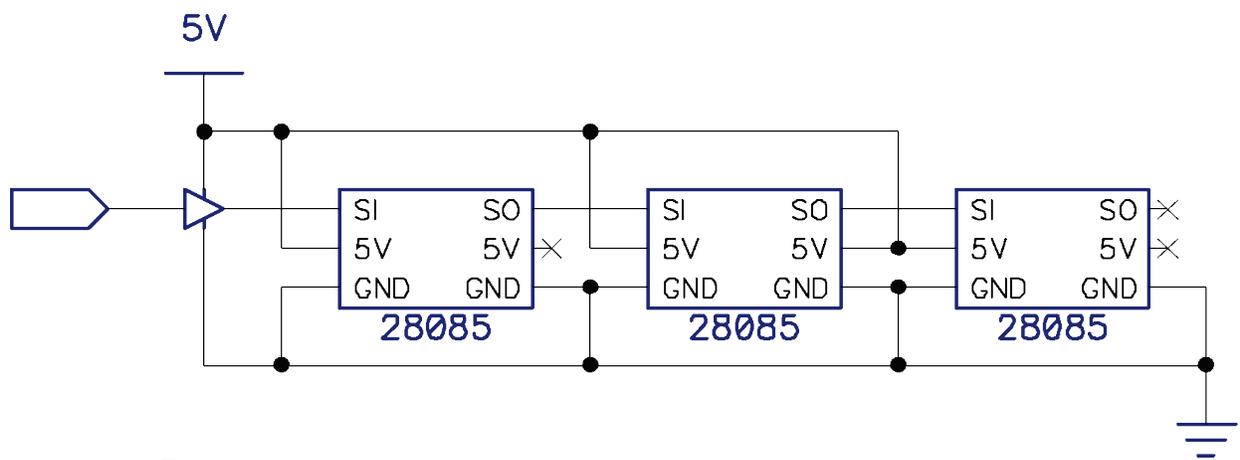


Connecting Multiple WS2812B modules

Each WS2812B module outputs a signal to drive the next module in a series. The signal operates at the supply voltage of the module creating the signal, so there is no need to buffer the signal between modules.

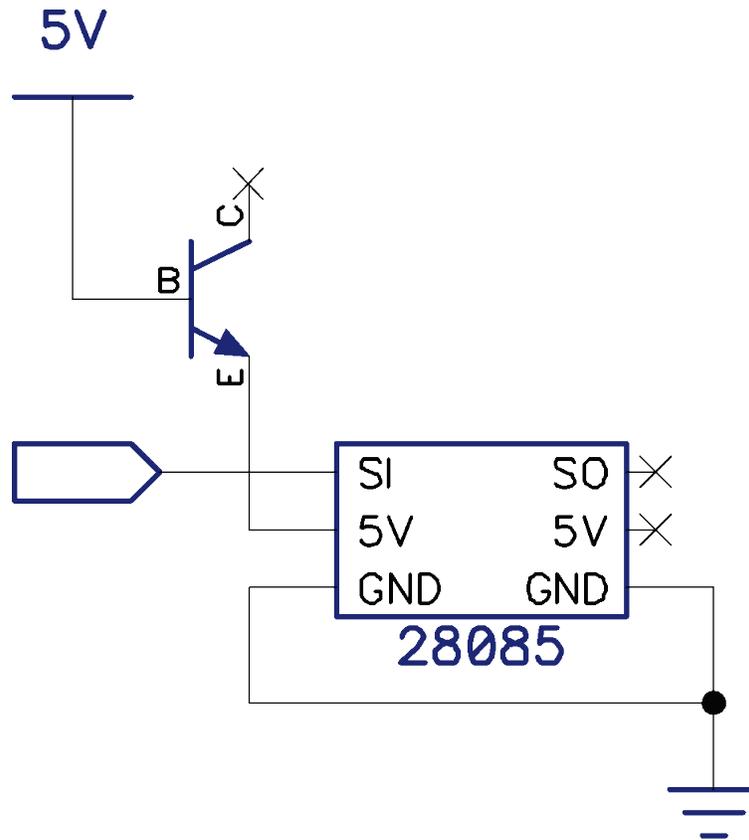
If a module is running at a reduced voltage to accept a 3.3-volt signal, its output voltage will be high enough to drive a module running at 5 volts, so the remaining modules can connect directly to the 5-volt power supply.

The following schematics show each method again (buffer, top; diode, bottom), each with three WS2812B modules.



Using a Transistor from a Propeller Education Kit

Several Propeller microcontroller education kits offered by Parallax Incorporated include a component pack with a 2N3904 transistor, but do not include any standard silicon diodes. It is possible to use the base and emitter of the 2N3904 as a standard silicon diode for reducing the LED module's supply voltage, as is shown in the following schematic:



Revision History

Version 1.0: Original release.